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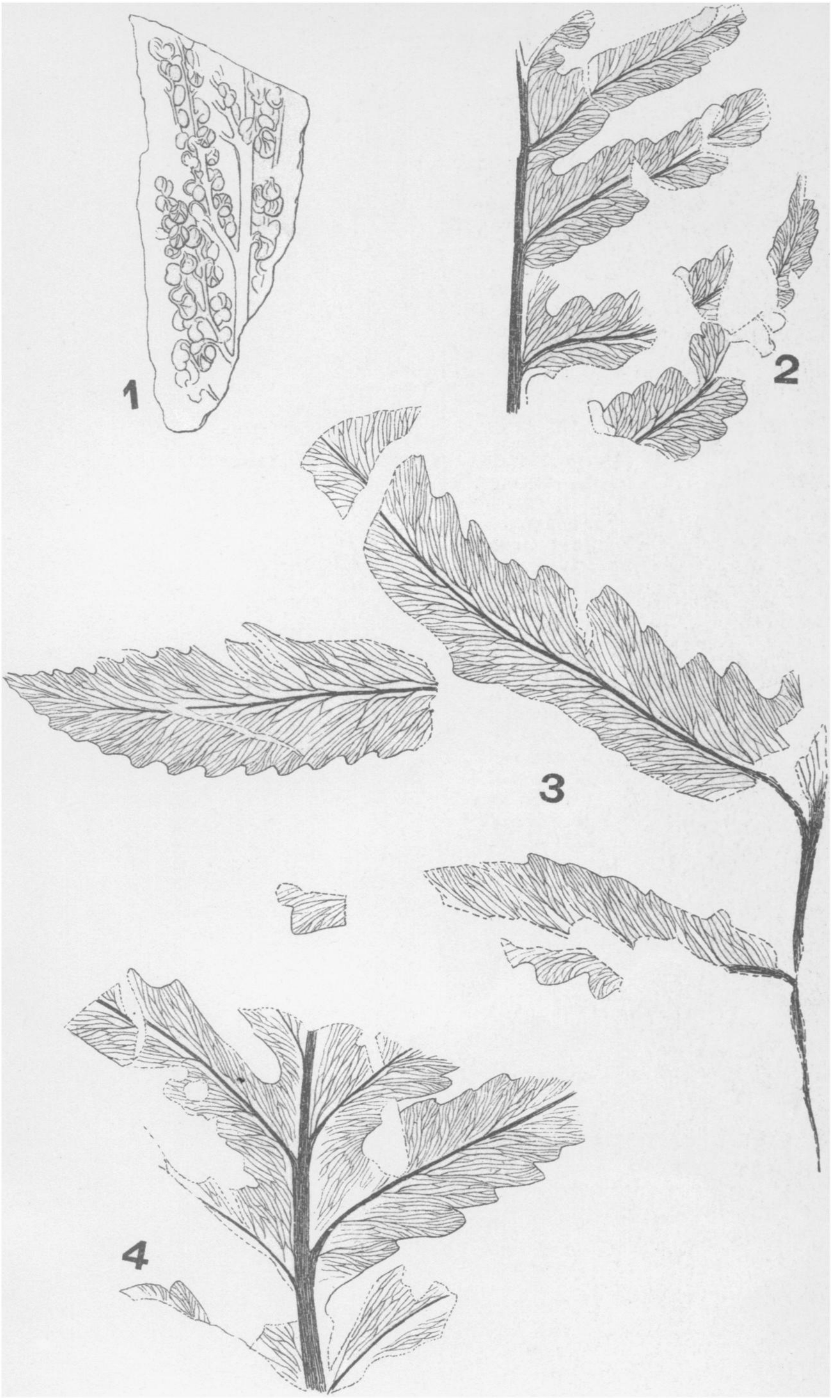

ONOCLEA SENSIBILIS FOSSILIS.

HELIOTYPE CO., BOSTON.

Report on a small Collection of fossil Plants from the Vicinity of Porcupine Butte, Montana*

BY F. H. KNOWLTON

(WITH PLATE 26)

The following report is based on a small collection of fossil plants made by Mr. Walter Harvey Weed, of the U. S. Geological Survey, in July, 1892. They come from the sandstone series above the bend of the Sweet Grass, west of Porcupine Butte, Montana, and embrace about twenty pieces of matrix. Only the four following species of plants have been determined, although there are fragments of stems, apparently of grasses, and others of dicotyledonous leaves.

GLYPTOSTROBUS EUROPAEUS UNGERI Heer

Glyptostrobus Europaeus Ungeri Heer, Fl. Tert. Helv., **3**: 159. 1859; Lesquereux, Cret. & Tert. Fl., 222. *pl. 46. f.* 1–1^c. 1883.

The collection contains a number of small fragments that with very little doubt belong to this form as described and figured by Lesquereux. It is probably the same as that identified by Newberry as *G. Europaeus* Unger, in his *Later extinct Floras of North America* (24. *pl. 26. f. 6–8*), but, as I have stated in another place (*Catalogue of the Cret. & Tert. Pl. of N. A.*, 113), much confusion still exists regarding the status of these forms, which can only be settled by an adequate series of well-preserved specimens.

ONOCLEA SENSIBILIS FOSSILIS Newb. (*Pl. 26*)

Onoclea sensibilis fossilis Newb., Ann. N. Y. Lyc. Nat. Hist., **9**: 39. Ap. 1868; Lesquereux, Ill. Cret. & Tert. Plants, *pl. 8. f. 1–9; f. 1–5.* 1878; Newberry, Later extinct Floras, 8. *pl. 23. f. 3; 24. f. 1–5.* 1898.

This form was first described by Newberry in 1868, from material obtained by Dr. F. V. Hayden, near the mouth of the Yellowstone River, in Montana, in what are now known as the Fort Union beds. It has since been collected in approximately the same locality, and also along the North Saskatchewan, in beds of the so-called Canadian upper Laramie, which is of the same age as the Fort Union.

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Dr. Newberry based his determination entirely on the sterile fronds, and until the present time no fruit appears to have been found. This little collection made by Mr. Weed fortunately contains undoubted specimens of the fertile fronds, thus proving the correctness of Dr. Newberry's identification of the material with *Onoclea.*

At first thought it hardly seems probable that a form now living could have been in existence in early Tertiary times, and have been so little modified in coming down to us. This view appealed strongly to Dr. Newberry, and he sought diligently for characters by which to separate them. On this point he speaks as follows: "Varying as the living *Onoclea* does, in size, outline, and nervation of the sterile frond—from six inches to three feet in height, from a finely reticulated to an open dichotomous nervation, from a bipinnate frond, with remote obovate pinnules, to a pinnate form with wave-margined pinnae and broadly alate rachis—it plainly includes all the characters of the fossils before us, and I, therefore, find it impossible to separate them." As a matter of fact, about the only point of difference lies in the somewhat more robust habit of the fossil forms, and this obviously can have but little weight.

This close similarity is still further emphasized by the fertile fronds which are here figured for the first time. The best of the several fruiting fragments, shown in *Pl. 26, f. 1*, is quite well preserved, and does not exhibit any particular difference from the fruit of living examples. It has, as may be seen, a strong rachis and the numerous berry-like pinnules arranged along the slender branches, exactly as in the living fronds. For the present at least it seems impossible to do more than retain it under the above name.

ARALIA NOTATA? Lesq.

Aralia notata Lesq., Tert. Fl., 237. *pl. 39. f. 2–4.* 1878.

The collection contains fragments of two large leaves that appear to belong to this species.

Tilia Weedii sp. nov.

Leaf large, of firm texture, broadly cordate-ovate or nearly orbicular in outline, rounded above (apex not preserved) and broadly rounded below to a cordate, very slightly unequal-sided base; margin not well preserved but apparently coarsely toothed; nervation palmate, strongly 5-ribbed from the base; central or midrib strong, somewhat flexuose, with about 4 pairs of alternate strong secondaries, which arise at an angle of about 45°, arch

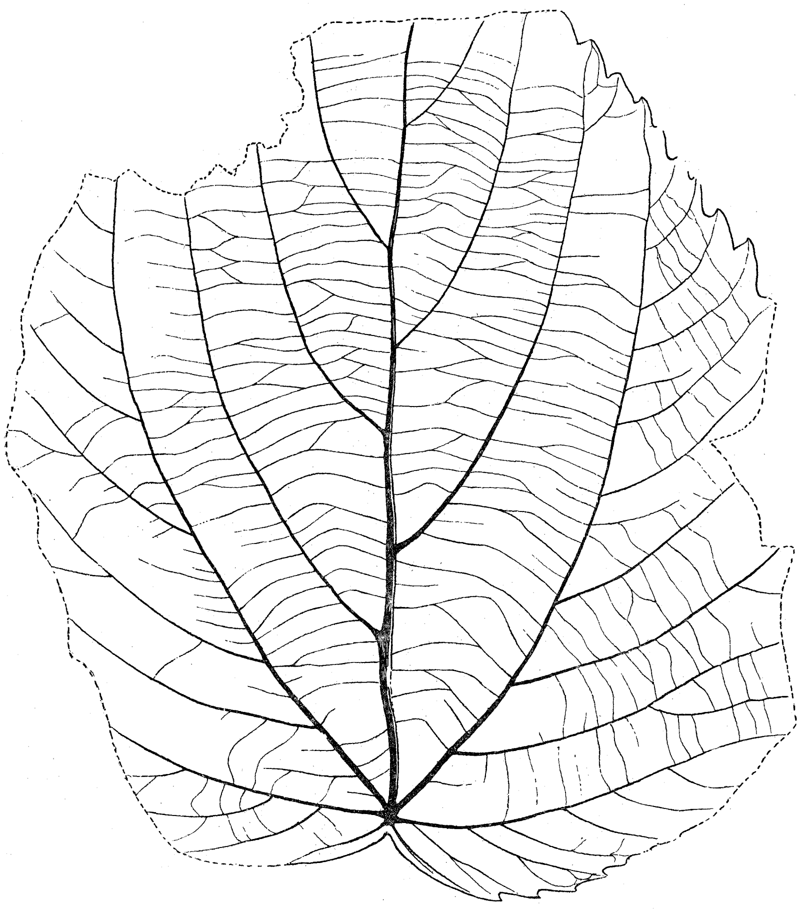

FIG. 1. *Tilia Weedii*, sp. nov.

upward and produce a few branches on the lower side, all of which apparently end in the marginal teeth: upper pair of ribs nearly as strong as the midrib, curving by a broad bow and passing up nearly to the end of the blade, each with from 7–9 secondary branches on the outside which fork and probably end in the teeth; lowest pair of ribs slenderer than the others, arising nearly at a right angle to the midrib, slightly arching upward and provided on the lower side with some 6 or 8 secondary branches, which also apparently fork and end in the teeth; nervilles numerous, strong, mostly percurrent and unbroken; finer nervation producing quadrangular areas.

The example figured was the only specimen contained in the collection; unfortunately it is not perfectly preserved, especially in its margin. It appears to have been very broadly cordate-ovate or almost orbicular. As now preserved it is 11 cm. in length and about 10 cm. in width. From the configuration it seems hardly probable that it was more than 1 or 2 cm. longer or 1 cm. wider when living. The base is distinctly cordate, with well-rounded lobes. The margin, as already stated, is not well preserved, but from the manner in which the veins fork it was probably toothed throughout, with the veins ending in these teeth. The nervation is well shown in the figure.

On account of lack of knowledge regarding the margin it is impossible to compare this leaf closely with other species. At first sight it seems to be identical with *Viburnum antiquum* (Newb.) Hollick,* which was called *V. tilioides* by Ward,† but this species is not strictly palmately ribbed, although approaching it in some specimens. The most important point of difference is in the secondaries, these being distinctly dichotomous in *V. antiquum*, and branching on the lower side in the leaf under consideration.

It may be compared with *Tilia populifolia* Lesq.,‡ from Florissant, Colorado, this species being of about the same size. It has the margins deeply and regularly serrate, but appears to differ essentially in nervation. It is 5-ribbed from the base, as in ours, but the midrib is perfectly straight, with more numerous thin, straight secondary branches, and the upper pair of ribs do not arch upward but pass straight to the margin on the same angle that they arise. The secondary branches are also thinner. They fork, however, sending branches into the teeth, as presumably the present one does.

Among living species this form seems to approach most closely to *T. Americana*, which agrees well in size and nervation. The living species is usually more unequal-sided at base than the fossil, but there is variation in this respect, certain of the leaves being almost regular below. In the fossil leaf the midrib is proportionally thicker, more zigzag and the first pair of lateral ribs more curved upward. The nervilles and finer nervation are practically the same.

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* Later Extinct Floras, 128. *pl. 33. f. 1, 2.*

† Types of the Laramie Flora, 107. *pl. 50–52. f. 1, 2.*

‡ Cret. & Tert. Fl., 179. *pl. 34. f. 8.*

I have named this species in honor of the collector.

AGE OF THE BEDS AS INDICATED BY THE PLANTS

The number of species, although small, is sufficient to give a pretty clear idea of the age. Four species have been enumerated, three of which were previously known. Of these *Onoclea sensibilis fossilis* has only been found in the Fort Union beds, at the mouth of the Yellowstone and in the Canadian Upper Laramie. *Aralia notata* was described originally from the Fort Union and has only been found in beds of similar age in the Yellowstone National Park. *Glyptostrobus Ungeri*, if this be the proper name by which to call it, is abundant in the Fort Union beds, and has also been found elsewhere. The new species (*Tilia Weedii*) is of uncertain affinity and is therefore of little value in this instance. The things it most resembles belong to the Fort Union.

Taking into account the locality whence these plants came the character of the material and the species as above enumerated, I do not hesitate to say that the beds in which they occur should be referred to the Fort Union.

Explanation of Plate 26

FIG. 1. Fruiting frond of *Onoclea sensibilis fossilis* Newb.

FIGS. 2–4. Sterile fronds of same.